

NEW SPECIES AND SYNONYMY IN THE GENUS  
MELEOMA (NEUROPTERA, CHRYSOPIDAE),  
WITH A DISCUSSION OF GENITALIC  
HOMOLOGIES

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ABSTRACT

Three new species of *Meleoma* are described, *carapana* from Mexico, *poolei* from Venezuela, and *festivata* from Colombia. *M. dolicharthra* (Navás) (= *M. cavifrons* Banks, new synonymy) is redescribed; *M. tezcucana* (Banks) (from *Chrysopa*) new combination, is recorded from Arizona. The pseudopenis of Chrysopidae is homologous to the mediuncus; the secondary mediuncus of *Meleoma* derives from fused gonocoxite dorsal horns as found in *M. poolei*, members of *Chrysopa* s. str., and the *Chrysopa lineaticornis* group.

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## INTRODUCTION

Two of the new species described below represent the first records of this genus from South America. *Meleoma* is a highly specialized derivative of *Chrysopa*, in which the majority of species show secondary sexual dimorphism or possess a stridulatory mechanism which is unique for Neuroptera. The two new South American species appear to be transitional between *Chrysopa* and *Meleoma*, both in male genitalic characters and in structure of the male frontal pit and horn; they are therefore of significance both toward understanding evolutionary trends and in interpreting genitalic homologies in *Meleoma*.

Tjeder (1966) recognizes several subgenera of *Chrysopa*, based upon male genitalic characters. In some cases, it is not possible to assign females to these subgenera without having associated males of the same species. Similarly, it would not be possible to assign females of some species to *Meleoma*, unless the associated males were known. Therefore the suggestion put forth by MacLeod (personal communication) that *Meleoma* be considered a subgenus of *Chrysopa* has considerable merit. On the other hand, I regard the specializations of the male genitalia, together with the very unusual modifications of the male head, or wing veins, and the stridulatory apparatus, as sufficiently important to warrant continuing the traditional generic separation from *Chrysopa*.

## ABBREVIATIONS

ac—acumen; bg—bursal gland; coll.g.—colleterial gland; dh—dorsal horn; fc—fertilization canal; gcx—gonocoxite; gs—gonarcus; gsac—gonosaccus (sclerotized sac beneath mediuncus); hy.i.—hyandrium internum; mu—mediuncus; ovd—oviduct; psm—pseudomedia; Rs—radial sector; sb—sclerotized band connecting mediuncus and gonarcus; smu—secondary mediuncus; sp—spermatheca; 8S—eighth sternite; 8T—eighth tergite; 10S—tenth sternite, or subanale.

***Meleoma carapana*, sp. n.**

## Figures 1-7

DESCRIPTION OF HOLOTYPE. Head (Figs. 1, 2): maxillary palpi black-spotted exteriorly; clypeus and vertex yellow-green, clypeus black-bordered, vertex with two faint reddish stripes. Ocular border and genae paler, brown genal spot barely distinct. Clypeus angulate anteriorly, with median ridge; frons elevated, with two prominent tufts of hairs bent posteriorly and laterally. Shallow transverse depression below antennae, with oval median aperture to seta-lined cavity; below each antenna, a small oval setose sclerite, below the horn a larger oval plate bearing short, spinose microtrichia. Frontal horn hardly extends beyond antennal articulation, squarely truncate, with two lateral and one median hair tufts, and two shallow dorsal oval depressions. Vertex low. Scapes long, straight, somewhat bulbous apically. Flagellum unmodified. Pronotum with red spot on each anterior corner, and a very thin anterior median red line; sides straight, anterior margin curved, sulcus lies  $1/5$  of length anteriorly to posterior margin, preceded by a prominent transverse ridge; a few pale setae laterally, bare medially. Body and legs green, no median pale stripe.

Forewing: longitudinal veins green, costal veinlets pale anteriorly, those near wing base dark for most of their length; transverse veins and branches of Rs dark at ends, gradates entirely dark, a few marginal veinlets dark at the forks. Hindwing: veins green except several costal veinlets and anterior ends of radials, dark. Setae pale, short, sparse. In forewing, entire radial system slightly inflated, especially the radial crossveins under the stigmal base, at their posterior ends. Forewing costals 22, 25; radials 14, 13, free branches of Rs 8, 9; inner gradates 7, 7; outer gradates 7, 8; seven apparent crossveins in pseudomedial space beyond intramedian cell. Length/width of third gradate cell from wing base 3.8; height of costal area/width of longest costal cell 1.74; width of radial area/height of costal area 1.34.

Genitalia. Ninth tergite and ectoprocts inflated dorsally, blunt apically, setae on posterior surface medially directed (Figs. 3, 4). Secondary mediuncus broad-based, apex slender, down-curved,

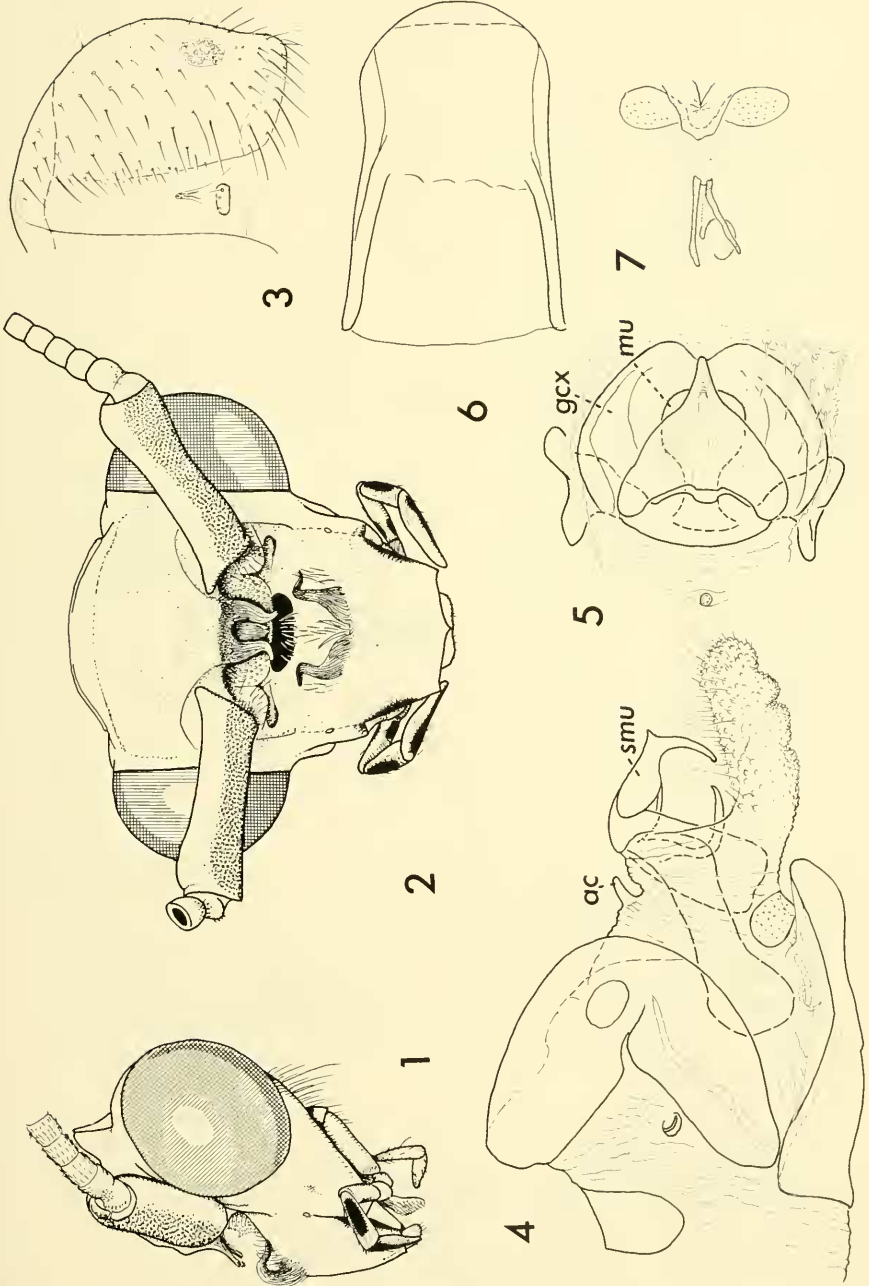
with blunt dorsal spine (Figs. 4, 5). True mediuncus, or "pseudopenis" (mu) narrow basally, broadly paddlelike apically, upcurved. Gonocoxites (gcx) form sides of bowl-shaped depression. Membranous ventral sac bears long setae dorsally; ventral and lateral surfaces bluntly microspinose. Transverse arch a small papilla ("acumen", Fig. 4, ac); tenth sternite a small transverse oval. Gonapsis as in Fig. 7 (right); hypandrium internum with large comes attached near gonopore.

MEASUREMENTS. Forewing length 15.5 mm, width 4.8 mm; pronotal length/width ratio 1.06; antenna about 9 mm.

HOLOTYPE. Male, 3 miles east of Carapan, Michoacán, México. 10 July 1963, F. D. Parker and L. A. Stange, leg. Peabody Museum of Natural History. (No other specimens seen.)

DISCUSSION. This species is related to *Meleoma hageni* Banks. *M. hageni* differs in having a larger cavity, extending nearly the full width of the face, a longer frontal horn, with shorter setae, and scapes (about 2/3 as long as in *M. carapana*), each with prominent round anterobasal bulge, stouter flagellum, and black genal stripe. The mediuncus of *M. hageni* is more slender, with two small, dorsal, winglike projections instead of a median horn, and the pseudopenis is upcurved and slender, with a pointed tip. The wings are similar, but in *Meleoma hageni*, the basal costal veinlets are black only at their bases (for most of their length in *M. carapana*). The marginal fork of psm is 2.9 times longer than wide in *hageni*, and 1.8 times in *carapana*; *hageni* has longer setae on the veins. The pronotum of male *hageni* has a dense covering of very short, fine setae; in *carapana* it is bare, except for a few pale marginal setae.

FIGS. 1-7, *Meleoma carapana*, n. sp., holotype (male). 1-2) head, extent of red scape marks indicated by stipple; 3) right ectoproct and 10th sternite, apical view; 4) abdominal apex, lateral; 5) genital armature, dorsal; 6) 8th and ninth sternites, ventral; 7) hypandrium internum (left) and gonapsis (right) (same scale as Fig. 5).



***Meleoma dolicharthra* (Navas), n. comb.**

Figures 8-10, 12

*Chrysopa dolicharthra* Navás, 1914, Ann. Soc. sci. Bruxelles 38: 96. Holotype ♂, "Capetillo, Guatemala, G. C. Champion, Godman-Salvin Collection, 1913—214," Brit. Mus. (Nat. Hist.).

*Meleoma dolicharthra* Kimmins, 1940, Ann. Mag. Nat. Hist. (11)5: 448; Banks, 1945, Psyche 52: 172.

*Meleoma cavifrons* Banks, 1950, Psyche 57: 46. *New synonymy*. Holotype ♂, "Pinecrest, Tuolumne Co., Calif., VII-10-48 (P. H. Arnaud, Jr.), MCZ No. 28350," Mus. Comp. Zool.

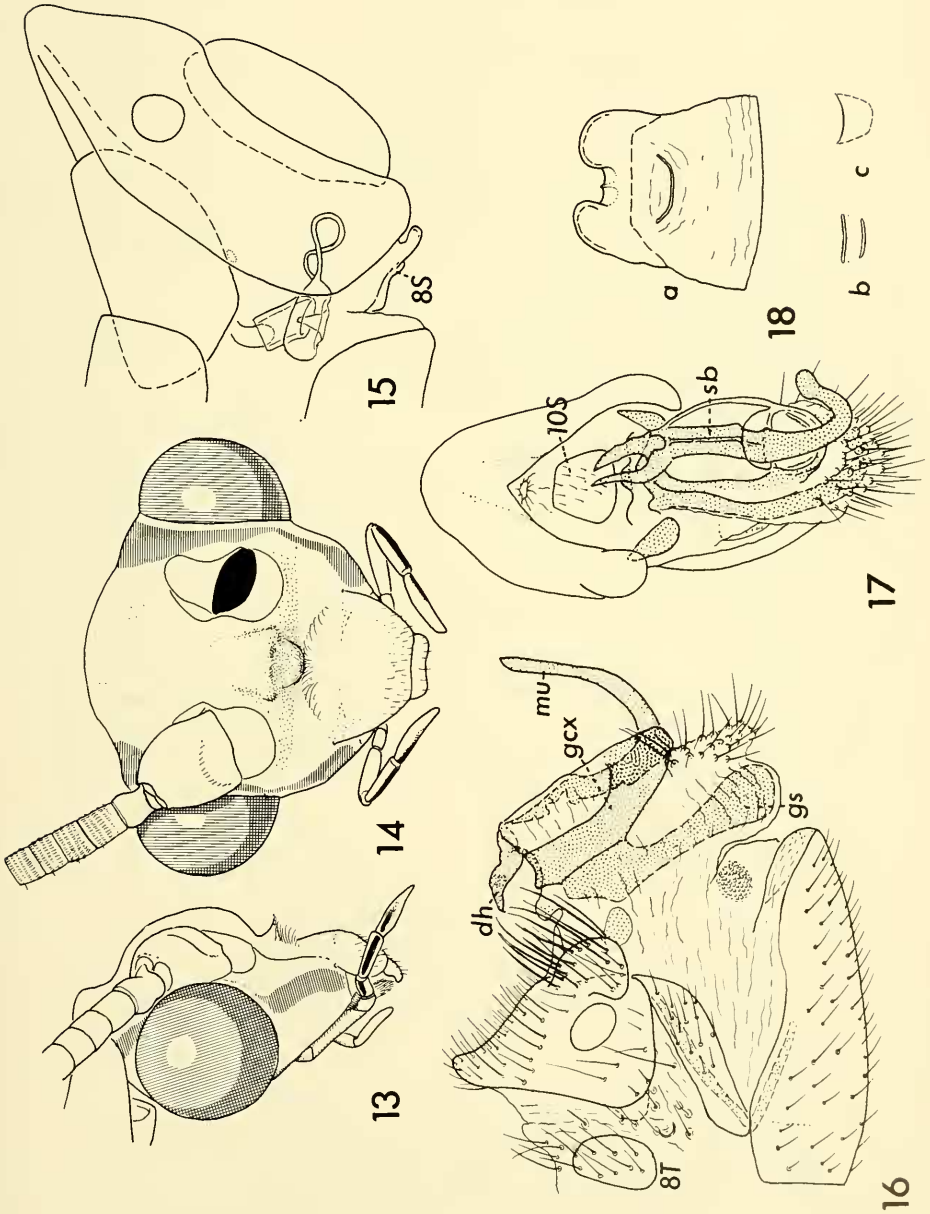
DESCRIPTION. Interantennal horn bifid, and densely setose apically (Fig. 9). Median horn slender with hook-like apical expansion, and lateral hair-tufts (Fig. 8). Facial cavity wide, with deep lateral pits. Frons inflated, bearing a few short hairs beneath frontal horns. Scape slender (in the figure, the right antenna has been drawn as if rotated upward, to show a frontal view; in the type of *dolicharthra*, both scapes point anteriorly). Anterior clypeal margin angulate, with small median ridge. Abdominal apex similar to that of *carapana* (Fig. 4). Secondary mediuncus broad, with slight dorsal ridge, lateral margins downcurved; true mediuncus or "pseudopenis" upcurved, apex spatulate (Fig. 10, 12).

REMARKS. The synonymy of *Meleoma cavifrons* and *M. dolicharthra* was discovered during preparation of the description of *M. carapana*. Since no adequate description of either *M. dolicharthra* or *M. cavifrons* has previously appeared, drawings of the more important diagnostic features of the type of *dolicharthra* have been included. A fuller redescription will be given by Tauber (in press).

FIGS. 8-10, 12, *Meleoma dolicharthra*, holotype (male). 8-9) head; 10) genital armature, lateral, sclerites stippled; 12) same, dorsolateral, showing partially sclerotized sac beneath pseudopenis.

FIG. 11, *Meleoma tezcucana*, female; 8th sternite, ventral.





***Meleoma tezcucana* (Banks), n. comb.**

Figure 11

*Chrysopa tezcucana* Banks, 1948, *Psyche* 55: 157-158, Fig. 7, 11, 28, 31.

TYPES. Holotype: female, "Lomas de Chapultepec, Mexico City, 8-VIII-40, [leg.] A. Dampf, Mex. M.C.Z. Type #27993." In the Museum of Comparative Zoology. The abdomen, which is dry, in a vial on the pin beneath the specimen, was not dissected. Paratypes in the Mus. Comp. Zool.: female, "Cuernavaca, Mor., 1240 m, 26-IV-32, #2540," (Morelos, México; the number is probably an A. Dampf field number); "Mexico City, No. 437, A. Dampf, Mex." (D. F., México, no date).

OTHER SPECIMENS. In the Peabody Museum of Natural History, there are two specimens from the United States: a male from Carr Canyon, Huachuca Mts., Cochise Co., Ariz., 28 Feb. 1964, leg. R. F. Sternitzky; a female from Sierra Vista, Cochise Co., Ariz., 16 June 1964, leg. R. F. Sternitzky. Both of the Yale specimens have dark-bordered gradate veins.

REMARKS. The eighth sternite of the Arizona female has a well-developed pocket, and the anterior margin is not distinctly delimited (Fig. 11). A complete redescription of this species will appear in Tauber's forthcoming revision of *Meleoma*.

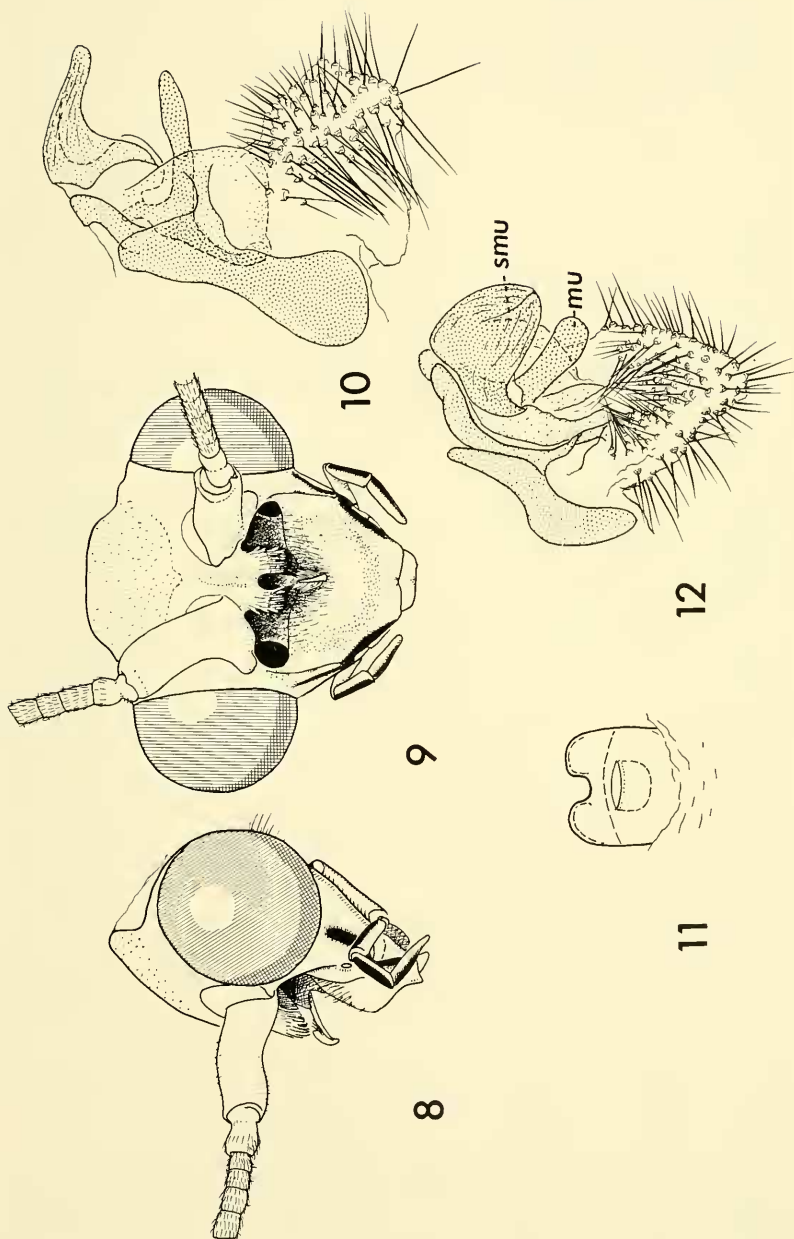
***Meleoma poolei*, sp. n.**

Figures 13-18

DESCRIPTION. Face (Figs. 13, 14) green, vertex ochre-yellow medially, pale laterally; clypeus unmarked, or red laterally; red

FIGS. 13-18, *Meleoma poolei* n. sp.: 13-14) male head, grey tone indicates red markings; 15) female abdomen, lateral, spermatheca shown *in situ*; 16) (holotype) male abdomen, lateral, gonarcus arms extended farther than natural to show shape of parts, transverse arch and heavily sclerotized portions of gonarcus and its appendages, stippled; 17) same, apical view; 18) female 8th sternite, ventral. a—pocket area, with single lip, b—pocket area, showing two lips, c—same, fully developed pocket present.





genal stripe sometimes confluent with lateral red stripes on frons, extending to vertex. Usually, two small red vertex spots. Male: labrum emarginate; clypeus very slightly convex; lower face flat, sloping upward across middle of frons, so that antennal bases lie on large bulge separated by distance equal to scape width. No interantennal horn, but a low, nearly quadrangular bulge, bearing a ligulate group of partially fused setae on transverse anterior ridge. Antennae pale, scapes subglobose, flagellum slender, basal segments slightly inflated. Female face little modified, scapes separated by 0.9 scape width; flagellum less inflated than in male, basal segments as long as wide. Maxillary palps black-lineate exteriorly.

Pronotum about as long as wide, anterior margin rounded laterally, deep sulcus at one half length. Thorax green dorsally with broad white or yellow median stripe. On pronotum, pale stripe is bordered laterally with broad red stripes, extending to sulcus; two smaller spots on posterior border. Pink spots on mesoprescutum and mesoscutum, bordering median stripe. Pleura and sterna white. Abdomen narrowly green laterally, with ivory median stripe irregularly bordered laterally with red.

Wing veins pale green; in forewing, transverse veinlets and crossveins red at ends, gradates red, cubital crossveins red. Marginal veinlets red at the forkings. Forewing slender, costals 22-(24.3)-27; radials 12-(12.6)-15, free branches of Rs 8-(♀ 9.6, ♂ 9.3)-10, inner gradates 7-(7.7)-9, outer gradates 8-(♀ 8.7, ♂ 8.3)-10, apparent pseudomedial crossveins beyond intramedian cell 7. Gradate series subparallel, inner series about halfway between Rs and outer series. Wing setae dark, curved, as long as about 0.4 width of gradate cells.

Male genitalia. Eighth tergite (Fig. 16, 8T) represented by two lateral plates. Ninth tergite and ectoprocts pointed dorsally, bearing rounded apical lobes, posterior margin with dense series of medially curved bristles. Callus cerci prominent, green in dried material. Gonarcus bears two dorsally directed hooks (Fig. 16, 17, dh); true mediuncus or "pseudopenis" ( $\mu$ ) clearly connected to gonarcus, arising from bowl-shaped depression with transverse partition; gonocoxites ("parameres") connected to bowl. Ventral sac with slender setae, membrane not spinose. Transverse arch represented by oval lateral plates and weakly sclerotized median papilla. Tenth sternite very large, setose. Gonapsis consists of

lateral oval fields of short, spinose microtrichia, not sclerotized medially. Hypandrium internum with large comes, similar to that of *carapana* (Fig. 7, left), but not lying so near the genital opening.

Female genitalia. Abdomen (Fig. 15) very sharply acute; eighth sternite (Fig. 18) with one or two sclerotized lips on membrane, or small pocket, small median tooth on posterior margin, weakly sclerotized anteriorly to intersegmental fold.

MEASUREMENTS (mm, for females N=10, for males N=3, means in parenthesis). Forewing length ♀ 15.5-(16.1)-16.5, ♂ 15.0-(15.3)-15.5; width ♀ 5.2-(5.3)-5.5, ♂ 4.7-(4.8)-5.0; pronotal length/width, ♀ (1.06), ♂ (1.13); length/width, third gradate cell from base of forewing, ♀ (2.35), ♂ (1.88); height of costal area/width of longest costal cell, ♀ (2.36), ♂ (2.47); height of radial area/height of costal area, ♀ (1.1), ♂ (1.2); antenna length (estimated) 10-12.

TYPES. Holotype: male, Rancho Grande, 7 km N. of Maracay, Aragua Prov., Venezuela, 25 June 1967, leg. R. W. Poole, 1100 m, at mercury vapor lamp; Peabody Mus. Nat. Hist. Paratypes (same locality and year): males: June 18 (Mus. Comp. Zool.), June 20 (Beard Coll.), July 7 (Adams Coll.); females: June 9 (1, Peabody Mus. Nat. Hist.), June 12 (1, E. MacLeod Coll.), June 25 (3—2, Mus. Comp. Zool., 1, Peabody Mus. Nat. Hist.), July 5 (1, P. Adams Coll.), July 7 (1, Beard Coll.), July 8 (5—3, Beard Coll., 1, U. S. Nat. Mus., 1, Univ. Central de Venezuela, Maracay), August 3 (2, Beard Coll.), August 5 (1, C. Tauber Coll.).

REMARKS. Until the discovery of this species, the southernmost record for *Meleoma* was Costa Rica (Tauber, in press). The species is named for the collector, R. W. Poole; all of the material formerly was in the collection of Robert Beard.

### ***Meleoma festivata*, sp. n.**

Figures 19-26

DESCRIPTION. Head (Figs. 20, 21) pale, lower face greenish, vertex orange, red stripes between vertex and eye, and on genae. Antennae pale, scapes yellow above. Maxillary palpus thinly black-lineate

exteriorly. Low median elevation anterior to antennae, bearing small tuft of setae apically; clypeus little elevated, frons slightly depressed posterior to frontoclypeal suture, surface porose anteriorly. Flagellum inflated and rigid basally, with short pale setae.

Thorax (Fig. 19) and abdomen green laterally, with median stripe ivory except yellow on pronotum, meso- and metascutella. Red marks on cervical sclerite near opening of scent glands, anterolateral border of pronotum, and elsewhere on thorax as indicated by dark shading in Fig. 19; abdominal ivory stripe red-bordered. Anterior pronotal margin probably rounded in life; corners angulate in dried material; sulcus moderately deep, preceded by narrow ridge.

Wing setae sparse, moderately long, decumbent. Venation pale; on forewing all crossveins wholly red except costals, apical radials, "pseudomedials" dark at ends; 2a-3a pale. Marginal veinlets red at forks. No inflation of Rs in male. Forewing costal area broad, anterior margin strongly convex; postcubital area broad. Forewing costal veinlets 24-25; radial crossveins 12; free branches of Rs+MA 8; inner gradates 5, outer gradates 7; 7 apparent crossveins beyond intramedian cell. Gradate series parallel except 2 basal inner gradates aligned.

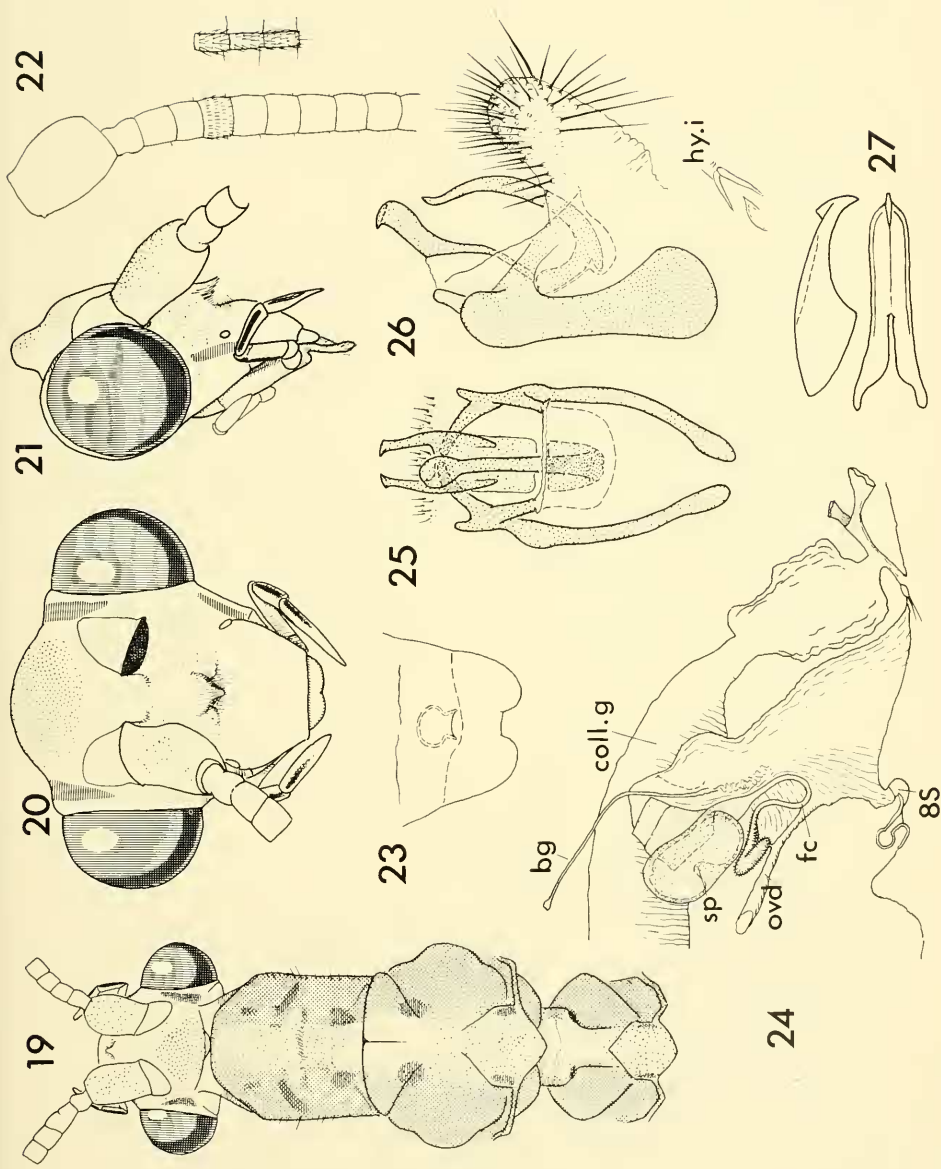
Hind wing pointed, postapical margin convex; veins pale, subcostals and radials faintly red at ends; outer gradates 6, inner gradates 4.

Male genitalia. Ectoprocts similar to those of *poolei*. Tenth sternite a narrow transverse band, close to gonarcus; transverse arch absent. Dorsal horns of gonocoxites flat, truncate, tips bent medially. Mediuncus bent more than that of *poolei*, arising from well-developed membranous pocket. Eversible setose lobe larger than in *poolei*.

Female genitalia externally like those of *poolei*. Eighth sternite lacks median tooth of marginal notch; flask-shaped cavity opens

FIGS. 19-26, *Meleoma festivata*, n. sp.: 19) male head and thorax, dorsal; darkest shading indicates red, even gray tone indicates green, and stipple indicates yellow or orange; 20-21) male head, left antenna omitted to show facial detail; 22) male right antenna, dorsal, base and segments near tip; 23) female 8th sternite, ventral; 24) female reproductive system, left lateral; 25-26) male genital armature.

FIG. 27. "MacLeod's *Meleoma*" (Tauber, in press), secondary mediuncus, showing double structure basally.





ventrally. Spermatheca with smaller ventral invagination; bursal gland ducts slender, bursa small; colleterial gland duct with flattened posterior chamber receiving two lateral ducts.

MEASUREMENTS. Male forewing length 12.8 mm, width 4.5 mm, length/width of third gradate cell from wing base 3.6; height of costal area/width of longest costal cell 2.7; width of radial area/height of costal area 1.04.

TYPES. Holotype: male, La Estrella (Antioquia), Valley of Medellín, Colombia, 1700-2000 m, at light, 8 May 1962, leg. Rev. B. Schneble; Mus. Comp. Zool. No. 31776. Allotype: female, same locality, 5 May 1962, E. G. MacLeod Collection.

DISCUSSION. This species is very similar to *poolei*, but *poolei* lacks the orange vertex mark, and the pronotum has a single stripe on each side anteriorly to sulcus. The face of *festivata* is flatter, the scale-like frontal hair tuft is smaller, and the frontal depression traverses the face in almost a straight line between the tentorial pits. The nearly flat faces of these two species, with scattered (glandular?) pores and small median hair tuft, undoubtedly represents the primitive condition, from which the deeper cavity of species such as *M. dolicharthra* has been derived. In *M. dolicharthra*, the female inserts her mouthparts into the frontal cavity during courtship (Tauber, 1966); presumably she ingests secretions which have accumulated within the cavity. In *M. festivata* and *M. poolei*, the median hair tuft may act as a wick, accumulating similar secretions.

The dorsal horns of the gonocoxites and 10th sternite of the male of *M. festivata* are distinctive. *M. festivata* resembles the other species of *Meleoma* more than does *M. poolei* in having a more loosely hinged mediuncus, lying in a better developed membranous pocket.

The gut structure and contents provide a clue to the feeding habits of these two species: the female *festivata* crop contained moth scales, but no pollen, as did one *poolei* crop. Another female *poolei* crop contained fungal fruiting bodies, and a few large, spheroidal pollen grains. If these species visit sap fluxes on tree trunks, these contents would largely be explained.



In both these species, the apex of the crop diverticulum is elaborately ruffled. In *poolei* the proventriculus is normal, while in *festivata*, a slender cylindrical middle segment allows passage of only small particles to the hind gut. Probably both species are primarily liquid feeders, with the other materials being ingested accidentally.

#### DISCUSSION OF GENITALIC HOMOLOGIES IN CHRYSOPIDAE

In the most primitive subfamily, Nothochrysinæ, the male genital apparatus is far simpler than in *Meleoma* (Chrysopinæ), consisting of an arched gonarcus, loosely hinged mediuncus, and a pair of gonocoxites articulated laterally on the gonarcus (Adams, 1967). This arrangement is clearly comparable to that in the other families of the Planipennia, is widespread in the Chrysopinæ, and in all probability represents the primitive condition for Chrysopidae. Despite apparently great divergence, the genitalia of the higher chrysopids can be derived from this ground-plan.

In the Chrysopidae, the mediuncus may be either rigidly attached to the gonarcus ("mediuncus" of Tjeder), or loosely hinged ("arcessus" of Tjeder); if quite distant from the gonarcus, and of a thin, rodlike shape, it is termed a "pseudopenis" by Tjeder. The pseudopenis is ordinarily connected to the gonarcus by a flexible sclerotized band (e.g., in *Chrysopa bimaculata*, Fig. 19, sb). As Tjeder (1966) states, the pseudopenis is not present if there is an arcessus, and vice versa. There appears to be little question but that the terms "mediuncus", "arcessus," and "pseudopenis" refer to different conditions of the same morphological structure. The equivalence of the mediuncus and pseudopenis has been pointed out previously (MacLeod and Adams, 1968).

In contrast to the usual condition in Chrysopinæ, all species of *Meleoma* but *poolei* and *festivata* appear to have both a mediuncus and a pseudopenis; this necessitates a secondary origin for one or the other of these structures in *Meleoma*. In *M. poolei*, the morphological identity of the pseudopenis is indicated by the sclerotized band connecting it to the gonarcus (Fig. 17, sb). This band is double, with an apparently unsclerotized median line. In most chrysopids, if the mediuncus is closely associated with the gonarcus, both the dorsal surface of the mediuncus and the flexible

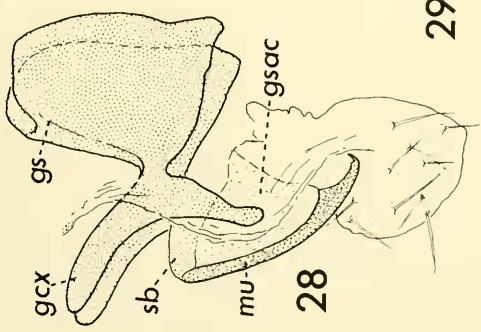
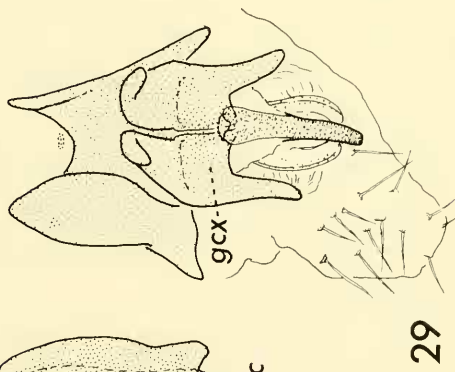
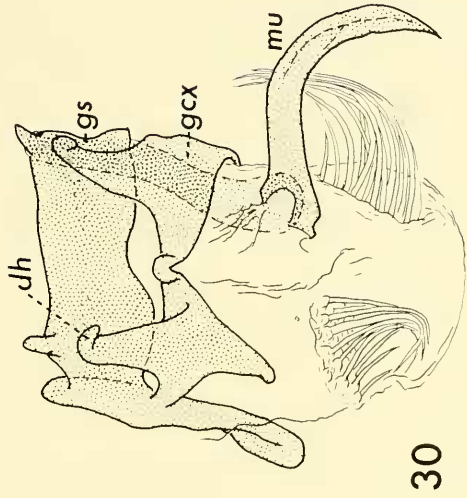
hinge, show a similar double structure, lightly sclerotized medially (Fig. 27). The "pseudopenis" of *M. poolei*, like that of other genera of chrysopids, appears equivalent to the mediuncus, but it includes an elongated hinge, so that the base lies remote from the gonarcus.

*M. poolei* is the only species of *Meleoma* with two dorsal horns on the gonarcus. The other species of *Meleoma* have, in addition to the true mediuncus ("pseudopenis"), a mediuncus-like structure that is attached to the gonarcus; according to my interpretation, the latter must be regarded as secondarily derived, presumably from the fusion of processes such as the dorsal horns of *M. poolei*. In *Meleoma*, the gonocoxites are not clearly delimited from the gonarcus, but form supports for a bowl-shaped depression lying below the "pseudopenis"; probably the dorsal horns of *M. poolei* are also part of the gonocoxites. The general configuration of the male terminalia in *M. poolei* resembles that in *Chrysopa* s. str. (Fig. 30, dh), in which the dorsally directed horns are more discernably part of the gonocoxites. Similar horns, in the *Chrysopa lineaticornis* group, also are apparently gonocoxite derivatives; frequently, as in *C. bimaculata*, the gonocoxites are closely approximated on the midline (Fig. 29). In the related *C. claveri* Navás, medial fusion is complete, so that a plate without obvious suture is interposed between the gonarcus and pseudopenis. The gonarcus-mediuncus-gonocoxite complex in this species group bears an unusual variety of horns and other processes. Considering the extreme plasticity shown by these structures, it does not seem unreasonable to conclude that the mediuncus of *Meleoma* has originated from medial fusion of the gonocoxites and their dorsal horns. This interpretation is supported by the tendency of the secondary mediuncus of *Meleoma* to show a bilobed condition basally (Fig. 27).

If terminology of genitalic structures is to be based upon morphological homology, a new term is required for the mediuncus-like lobe of *Meleoma*; *secondary mediuncus* is proposed.

FIGS. 28-29. *Chrysopa bimaculata*, internal male genital armature; 28) lateral view; 29) dorsolateral view.

FIG. 30 *Chrysopa oculata*, internal male genital armature, mediuncus turned to right, setal tufts partially expanded basally.



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